

Geo-technology and Environmental Ecology

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Title: Find Your "Ecohood" (ecological neighborhood)

Grade level: 9 through 12

Indiana Geography Standards:

GHW – Relate the following geo-spatial technology activity analyzing local ecology issues to the international applications of technology to large-scale ecology issues: 9.3.

WG – The following activities relate to or may be adapted slightly to relate to: 1.3, 1.5, 3.10, 5.9, 6.1 and 6.12.

Overview: Students are familiar with the term *neighborhood* used to describe the people or things that live near them. In this inquiry investigation, students use a variety of investigative tools – including global positioning system (GPS) units – to learn about local ecology¹. Students will understand that the ecology of localized areas differs from place to place, much like a neighborhood, and they will use global positioning to mark various locations as addresses within their ecological neighborhood or, as it is called in this exercise, their *ecohood*.

Prior knowledge: Older students with a background in basic ecology will understand and describe the abiotic and biotic factors in areas they choose around the school. Younger students will rely on and develop their ability to observe their natural surroundings as they investigate and explore these environments. All students will be introduced to the GPS unit and will become proficient in use of GPS units as they mark locations in their *ecohood*. Later, they will demonstrate proficiency by using GPS units to navigate and locate ecosystems identified for them.

Materials Required:

- Four to five eTrex[®] personal navigators (one for each group).
- Compass
- Index cards (lined on one side)
- Blackboard
- Outside area to study
- Journal (1 per group)

I. Engage students with a scientific question.

Initial Question: How do ecosystems around the school yard vary?

After an introduction, participants in small groups brainstorm ways ecosystems might vary at different locations around the school. They should generate questions about things that could affect ecosystems, such as

1. Type of soil
2. Use of pesticides or herbicides
3. Pollutants from litter or automobile exhaust
4. Foot traffic during the year

¹ An ecosystem is all of the organisms living in an area together with their physical environment.

Ecosystems range in size from very small to very large. For example, just as a prairie is an ecosystem, a vacant lot is an ecosystem too because it includes various organisms as well as rocks, soil, sunlight, water, and air.

5. Drainage patterns
6. Amount of sunlight.

Generating questions while identifying ecosystem:

Students form groups of three or four. Each group is given the following instructions:

Your task is to work with your team to investigate the different environments around the school. Use your knowledge of land use and your observation skills to categorize at least five different areas on or near the school grounds. Your team will be given five index cards, one for each ecosystem. On the unlined side, do your best to describe the location of the ecosystem. On the lined side, describe the features of the location. You can, for instance, consider

- How is this land used during the school year?
- How does the school control plant growth or insect pests?
- What plants and animals do you observe?
- How would you describe the soil?
- Is the land hilly or flat?
- What are the distinguishing features: standing water, rocks, hills?
- ... anything else you want to ask

In addition,

- (1) Write one statement per card on what sets this area apart from others as an ecosystem,
- (2) and Write one question about the ecosystem.

Remember to write clearly. Each person is responsible for writing down at least one card. This is a brainstorming process, so do not stop to edit questions. Write down all observations and questions, even those that might be quickly answered.

On returning to class, place the cards on a central table for later use.

III. Probe what students think they know about locations.

Initial question: How can you describe a location?

Have students brainstorm ways that they might locate a house, friend, classroom or a tree. Use a flip chart or the blackboard, to record student answers. Ask how they chose to locate their ecosystems. Accept all reasonable answers. Categorize these answers as: uses numbers, uses a nearby object (relative location), uses directional coordinates (north, west, east, south)... Help students realize that locations linked to nearby objects can be unreliable if the nearby object (such as a tree or building) changes.

Demonstrate: Play the radio advertisement for OnStar².

² OnStar is a factory-installed safety and security system that helps keep you protected and connected on the road. A live, specially trained Advisor is there to help you with something as major as an air bag deployment or as minor as a lockout.

Ask: How did the rescuers know where to find the vehicle? This will serve as an introduction to the GPS. Students will understand that GPS is a satellite-based navigation system consisting of a network of satellites orbiting the earth. Locations are identified by latitude and longitude coordinates in degrees, minutes and seconds.

Ask, how can GPS be used to identify locations of any one of the ecosystems in the schoolyard?

Introduce: Provide each group one eTrex® personal navigator. Assign two people in each group to be navigators. Give initial instructions and let students explore use of the probe. Note: students will need to go outside to accomplish this task. Students should then complete the following tasks (record answers in their journal):

- Task 1. Each group will be assigned outside waypoint (e.g. flagpole, stop sign, etc.) use the GPS unit to identify its latitude and longitude, to the nearest minute.
- Task 2. Each group will be told to go to the flagpole and walk with the probe, northwest to the nearest pine tree. Students will identify the distance to between the flagpole and pine tree. (Perform a similar task appropriate to your place.)
- Task 3. Repeat task 2, and check for repeatability.
- Task 4. The manual specifies that the accuracy of the GPS unit is <15 meters or 49 feet. Have students mark off that distance as a demonstration.

III. Design the investigation

Students brainstorm to place the index cards into categories. There will be some overlapping of areas, but for the most part, the areas should be different from one another. For example, students might identify areas such as the

- 1. "Front Yard" of school grounds (northwest corner of property)
- 2. Grassy islands (throughout the parking lot)
- 3. Athletic fields (east side of school building)
- 4. Weedy area behind bleachers (southeast side of property)
- 5. Outside courtyard (between the library and cafeteria)

Assign each group at random, one ecosystem to investigate. Provide all index cards concerning that ecosystem.

Assign group roles (2 navigators, 1 recorder, 1 in charge of equipment).

Allow each group time to formulate a key question to investigate about their ecosystem. They should also develop a way to characterize the ecosystem based on the organisms present and the nonliving environment.

IV. Collect data. Each group

- 1. Decide on the ecosystem size and use the GPS unit to mark its area. Record the dimensions in meters and record the coordinates in the group's lab journal.
- 2. Use the Internet or the GPS unit to mark the school property boundaries.
- 3. Collect data to answer your question. For example
 - a. Study the plants
 - i. Estimate the number of different types of plants.
 - ii. Collect a sample of leaves of at least 2 plants from the area to be identified in the classroom.
 - iii. In classroom, use keys to identify plants.

- b. Study of animals above and below ground (if season permits)
- c. Study of abiotic factors (such as soil, rocks, water).
- d. Develop a food web.
- e. Other

V. Analyze and interpret data

Each group will write a report describing their ecosystem. The report will identify the coordinates of the ecosystem, plot the size of the ecosystem, and describe the abiotic and biotic factors within the ecosystem. It will also summarize the outcome of their investigation.

The report will conclude with a description of how the ecosystem could be improved (for example: more attractive, more useful, better soil, less foot traffic, greater biodiversity). The class will choose one proposal from among the group's suggestions to present to the class.

VI. Summative activities

Each group submits the following

1. A map showing the location of the ecosystem within the school grounds.
2. Field notes.
3. Report.
4. Presentation materials

Each student submits the following

1. A brief summary explaining their role in the project, their ecosystem, and
2. A description of what they would do differently if they had to do this project again.

Each student is quizzed on the use of a GPS unit. (Try for a small grant or invite a local surveyor or other person to help – many have GPS units and are experts in the use and applications of a GPS unit and are willing to be involved with the students.)

V. Extension and reinforcement activities

1. Each group will be given coordinates from another group's ecosystem. Using the GPS unit, the group will locate the ecosystem and describe it. Their description will be compared to the initial group's description.
2. Develop a plan to enhance one of the ecosystems. What would you do? Estimate the cost? How would you propose this to the school board?
3. Identify additional practical uses for the GPS units.

References

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